



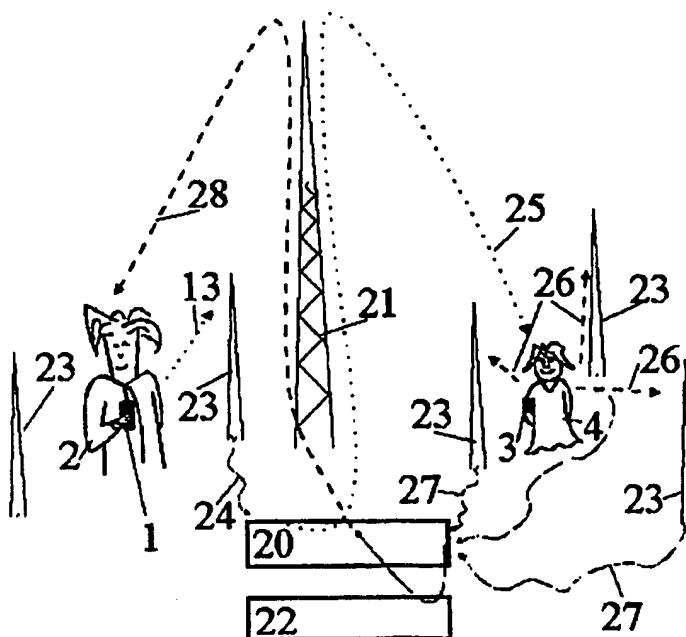
## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification <sup>6</sup> : <b>G01S 5/14, 13/87</b>	<b>A1</b>	(11) International Publication Number: <b>WO 99/49331</b> (43) International Publication Date: 30 September 1999 (30.09.99)
<p>(21) International Application Number: PCT/IB99/00713</p> <p>(22) International Filing Date: 18 March 1999 (18.03.99)</p> <p>(30) Priority Data: 1008662 20 March 1998 (20.03.98) NL</p> <p>(71) Applicant: KONINKLIJKE KPN N.V. [NL/NL]; Stationsplein 7, NL-9726 AE Groningen (NL).</p> <p>(72) Inventors: BLOK, Django; J.C. van Markenplein 2, NL-2613 AE Delft (NL). AASMAN, Jannes; P.O. Box 95321, NL-2509 CH The Hague (NL). FEIJEN, Maurice, Matthias; P.O. Box 95321, NL-2509 CH The Hague (NL).</p> <p>(74) Agent: KLEIN, Bart; Koninklijke KPN N.V., P.O. Box 95321, NL-2509 CH The Hague (NL).</p>	<p>(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).</p> <p><b>Published</b> With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments. In English translation (filed in Dutch).</p>	

(54) Title: MOBILE LOCATING SYSTEM

## (57) Abstract

Mobile locating system, particularly suitable for locating children, comprising at least one mobile search device, at least one mobile responder device, a communication network which enables at least communication from the search device to the responder device to activate the responder device from the search device, and a positioning system for generating positional signals relating to the position of the responder device, and passing on the positional signals to an exchange, provided with a geographical information system, of the communication network which is arranged to transmit positional information obtained from the positional signals by way of the communication network to the search device.



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# Mobile locating system.

The invention relates to a mobile locating system particularly suitable for locating children.

Locating systems are known in various embodiments. In PCT application WO 96/12264, e.g., there is described an object-locating system for locating objects such as, e.g., a vehicle. In this connection, the object is provided with an emergency transmitter which, if the object ends up in an abnormal situation, is capable of emitting an emergency signal which may be passed on to a central emergency station by way of a telecommunication network such as, e.g., the GSM network [GSM = Global System for Mobile communications]. Such a system, however, is not very suitable for locating children, since in most cases the emergency transmitter should still be activated by the child. A child, however, often does not know when it is being looked for by its parents, so that the parents will often try in vain to locate the child. Another drawback is the need of a central emergency station. In such a system, the parents who want to locate a child should first contact the emergency station and are not capable of directly verifying themselves where the child is.

In the U.S. patent specification 5,461,365, there is disclosed a personal emergency system which may also be used for monitoring children. Said known system also comprises a base station and a portable unit which may have an emergency button but which may also be arranged as a mobile phone. Said system results in similar drawbacks as the system disclosed in WO 96/12264.

Furthermore, there are known systems in which parent and child each have small portable transceivers which may communicate directly with one another if so desired. Such a system has only a limited range and in addition is not capable of clearly indicating where the transceiver of the child, and therefore the child itself, is located.

This is why there is a need for a simple, user-friendly yet effective system for locating children, which overcomes the above and other drawbacks of the various known systems. According to the invention, for this purpose a mobile locating system of the type described above is characterised by at least one mobile search device, at least one mobile responder device, a communication network which at least enables communication from the search device to the responder device for activating the responder device from the search device, and a positioning system for generating positional signals relating to the

position of the responder device and transmitting the positional signals to an exchange of the communication network provided with a geographic information system, which is arranged for transmitting to the search device the positional information obtained from the positional signals by way of the communication network.

Below, the invention will be described in greater detail by reference to the enclosed drawing of an exemplary embodiment.

FIG. 1 schematically shows a first exemplary embodiment of a mobile locating system according to the invention;

FIG. 2 schematically shows a second exemplary embodiment of a mobile locating system according to the invention;

figures 3 to 5 inclusive schematically show, in the form of block diagrams, several exemplary embodiments of a locating system according to the invention;

FIG. 6 schematically shows an example of a mobile search system for use in a locating system according to the invention.

FIG. 1 shows a first exemplary embodiment of a locating system according to the invention. To start with, it should be noted that, although the locating system was originally designed for, and is also described below with respect to, locating lost children or, e.g., locating children who, although they were not lost, are still located outside the field of vision of the parents or supervisors or the like, the locating system may also be applicable in other situations. There may be thought of, e.g., application to persons having health problems, or the mentally disabled, but also of application for specific pets.

The locating system shown in FIG. 1 comprises at least one search device 1 for a parent or supervisor 2, at least one responder device 3 for a child 4, a communication network 5 and a positioning system 6.

If a parent 2 desires to know where the child 4 is, the parent activates the mobile search system 1. Such a device may have approximately the size of a mobile phone, and is provided with several control buttons and a display screen, e.g., an LCD screen [LCD = Liquid-crystal Display] on which control information and also information received on the location of the responder device may be shown.

The search device is arranged to transmit, after activation, a

search signal which is picked up by any of the receiver antennae 7 of the communication network 5, and is broadcast by way of an exchange 8 of the communication network 5 and a transmitter antenna 9 connected thereto, as schematically indicated by arrows 10, 11. The search  
5 signal should contain a predetermined code which may be recognised by the responder device of the sought child, so that only said responder device reacts to the search signal. Apart from wireless connections, the network 5 may also contain fixed lines which may extend between, e.g., the exchange and the antennae, or between the exchange and  
10 possible sub-exchanges. The communication network may be an existing network for mobile telephony such as, e.g., the GSM network. A drawback of the existing network for mobile telephony is that it involves a sometimes extensive time for setting up the connection. Said drawback does not apply to a mobile data network such as, e.g.,  
15 the RAM [= random access memory] mobile data network.

The responder device 3 is arranged to react to the search signal of the associated search device 1. After receiving a correctly encoded search signal, the responder device activates a receiver for positional signals built into the responder device. The latter may be  
20 signals 13 transmitted, by way of satellites 12, by the existing GPS system (GPS = Global Positioning System). The responder device transmits to the exchange 8 the positional signals received by way of an antenna 7 of the communication network, as schematically indicated by arrows 14, 15. The exchange 8 is provided with a geographic  
25 information system 16 which determines the location of the responder device from the positional signals 16. Said location is then transmitted back, by way of the exchange 8 and the antenna 9, to the search device 1, as schematically shown by an arrow 17. The search device may be arranged to receive and process positional signals, so  
30 that in the search device it may be determined, from the difference between the position of the parent and the position of the child, in which direction and at which distance from the search device the sought child is.

As an alternative, the latter may be determined in the exchange,  
35 which is then capable of transmitting the information in question to the search device.

As an alternative to the GPS system, for positioning there may also be made use of another navigational network, e.g., an earthbound

5 navigational network having a number of radio beacons. The radius of such a network is geographically limited to a specific area, e.g., an amusement park, or a nature reserve or the Dutch territory. Such an earthbound navigational network may be more accurate than the GPS system. With only five radio beacons distributed throughout the Netherlands, there may already be obtained an accuracy of 10 metres. The responder device may transmit the positional signals received from the radio beacons by way of the GSM network to a central transmitter provided with a GIS (= Geographic Information System), which passes on the positional information to the search device. The use of the GSM network or a similar public wireless telephony system is obvious if the search signal is transmitted by way of the GSM network or a similar network as well.

15 FIG. 2 schematically shows a second exemplary embodiment of a locating system according to the invention. The locating system of FIG. 2 comprises a kind of "pager" network for two-way communication, it being possible to advantageously make partial use of the existing semaphore network, of which an exchange 20 and an antenna 21 are schematically shown. Once again, the exchange is provided with a GIS system 22. In addition, there is required a second network whose antennae 23 are shown.

The shown locating system operates as follows. The parent 1 operates the search device 2 to track a child 4 wearing a responder device 3. The search device then broadcasts a signal 19 which is picked up by one of the antennae 23. Said signals are transmitted to the exchange by way of the second network, as schematically indicated by an arrow 25. Then, said signals are broadcast by the semaphore network and picked up by the responder device 3, as schematically shown by an arrow 24. The responder device is activated by said signals to broadcast a reply signal which is picked up at various points by antennae 23, as symbolised by arrows 26. The antennae 23 transmit said received signals to the exchange by way of connections 27. Based on the signals received and the known location of the receiving antennae 23, the GIS system of the exchange calculates the position of the child, and the positional information obtained in this manner is once again transmitted to the search device by way of the semaphore network, as indicated by an arrow 28. In this system, therefore, the signal transmitted by the responder device may at the

same time serve both for positioning and for possible communication.

It should be noted that the communication between search device and exchange, or between responder device and exchange, respectively, may take place by way of various networks.

5 For completeness' sake, the figures FIG. 3, 4 and 5 schematically show, in the form of block diagrams, three examples of locating systems according to the invention, set up using the GSM network and an earthbound navigational system (FIG. 3), a mobile data network having a GPS system (FIG. 4) and a semaphore network  
10 supplemented by a network to be newly installed having earthbound antennae for positioning (FIG. 5).

The system shown in FIG. 3 comprises a position detection system 29 having radio beacons 30, synchronised by a clock 31. The radio beacons may be received both by the search device 1 and by the  
15 responder device 3 using receiver sections 32 and 33, respectively. The search device has controls such as buttons 34 and a display screen 35, an energy source such as a battery 36, a GSM transmitter section 37, memory means 38 and 39, a GSM receiver section 40 and a mathematical processor 41 which drives the display screen by way of  
20 the memory 39. Furthermore, in this example there is still provided a compass device 42.

The responder device 3 is set up more simply and has a supply source 44, a GSM receiver section 45, a GSM transmitter section 46, a mathematical processor 47 and memory means 48.

25 The exchange 8 receives signals from the GSM transmitter section 37 of the search device 1 and from the GSM transmitter section 46 of the responder device 3. Furthermore, the exchange in operation passes on the signals received. The exchange comprises a code data base 49, in which the various address codes of at least the responder devices  
30 are stored. Moreover, the exchange comprises a GIS system 50.

FIG. 4 schematically shows, in the form of a block diagram, a locating system according to the invention which is constructed using a mobile data network and which makes use of the GPS system. For positioning purposes, there are now available GPS satellites 51 which  
35 communicate with a GPS receiver 52 in the search device and with a GPS receiver 53 in the responder device. Furthermore, instead of GSM transmitter and receiver sections there are radio transmitter sections 54 and 55 and radio modems 56 and 57 available in the search device

and the responder device.

FIG. 5 schematically shows, in the form of a block diagram, an example of a locating system according to the invention which makes use of a semaphore network and a new network 60 having radio receivers 61 and a network exchange 62 which is, or is not, wirelessly coupled to, or is part of, the exchange 20 of FIG. 2. The radio receivers 61 are coupled to the antennae 23 of FIG. 2. The exchange 20 now contains, in addition to a code data base 49 and a GIS information system 50, yet another network data base 63 for positioning based on signals received from the radio receivers 61 by way of the network exchange 62. The search device 1 and the responder device 3 now each comprise a transmitter section 64, 65 for broadcasting signals to the receivers 61 of the network 60. Furthermore, both devices each comprise a semaphore receiver section 66, 67 for receiving signals which are transmitted by the exchange 20 by way of the semaphore network.

FIG. 6 schematically shows an example of a practical embodiment of a search device 1 for a locating system according to the invention. The device shown has a hand-holdable handle part 70 and a display part 71 provided with a display screen 72, e.g., an LCD screen. The display screen is preferably illuminated, so that it is capable of being read in the dark as well.

Furthermore, at 73, 74 and 75 there are shown control buttons. The buttons serve to switch the device on/off, to select the child to be sought in the event that more children are provided with a responder device. The screen is arranged to show the required information alphanumerically and graphically. This may be, e.g., a street name in combination with a number indicating the distance to the responder device and possibly a directional arrow. It is also basically possible to indicate the route to be followed, e.g., first road to the left, second road to the right, or to display a plan onscreen on which the positions of the search device and the responder device are displayed.

In the handle part 70, the batteries may be accommodated as indicated with dotted lines at 76, and possibly a part of the required electronic circuitry.

The responder device preferably has a shape attractive to the child and is provided with attachment means facilitating a good



fixation, e.g., to the wrist or arm of the child, or around the middle  
or to the clothing. The responder device preferably has an on/off  
switch which is placed in such a position that for the child it is  
difficult to reach. The button may be located, e.g., on the surface  
5 of the device resting against the body or the clothing of the child  
when in use. Furthermore, the device should of course be as resistant  
as possible to all sorts of environmental influences, shocks and  
impacts, water etc.

It should be noted that, after the above, various modifications  
10 will be obvious to those skilled in the art. Such modifications are  
deemed to lie within the scope of the following claims.

CLAIMS

1. Mobile locating system, particularly suitable for locating children, characterised by at least one mobile search device (1), at  
5 least one mobile responder device (3), a communication network (5;60) which at least permits communication from the search device to the responder device (3) to activate the responder device (3) from the search device (1), and a positioning system (6;29;60) for generating positional signals relating to the position of the responder device  
10 (3), and passing on the positional signals to an exchange (8;20) provided with a geographical information system (18;22;50) of the communication network (5;60), which is arranged to transmit positional information obtained from the positional signals to the search device by way of the communication network (5;60).  
15
2. Mobile locating system according to claim 1, characterised in that the positioning system (6;29;60) comprises a network (29) of radio beacons (30), which radio beacons (30) in operation transmit beacon signals which are capable of being received in at least the  
20 responder device (3) by a corresponding receiver section (32).
3. Mobile locating system according to claim 1 or 2, characterised in that both the responder device (3) and the search device (1) have a receiver section (32,33;52,53) for positional signals.  
25
4. Mobile locating system according to claim 1,2 or 3, characterised in that the search device (1) and the responder device (3) are connected to the exchange (8;20) by way of an existing public wireless telephony network.  
30
5. Mobile locating system according to claim 1, characterised in that the positioning system (6;29;60) is formed by a public GPS system, the search device (1) and the responder device (3) having corresponding GPS receiver sections (52,53).  
35
6. Mobile locating system according to claim 1, characterised in that the search device (1) and the receiver device (2) in operation are each in connection with the exchange (8;20) by way of a radio

modem (56) and a radio transmitter section (55), respectively.

7. Mobile locating system according to claim 1, characterised in that the positioning system (6;29;60) comprises a network (60) of  
5 radio receivers (61), which radio receivers (61) in operation are capable of receiving signals from transmitter sections (64,65) in the search device (1) and/or the responder device (3).
8. Mobile locating system according to claim 1 or 7, characterised  
10 in that the search device (1) and the responder device (3), respectively, has a semaphore receiver section (66,67) which in operation is capable of receiving signals from the exchange (8;20).
9. Mobile locating system according to claim 7, characterised in  
15 that the exchange (8;20) comprises a network data base (63) having information on the position of the radio receivers (61) for determining the position of a responder device (3).
10. Mobile locating system according to claim 7,8 or 9,  
20 characterised in that the network of radio receivers (61) comprises a network exchange (62), which is, or is not, wirelessly coupled to the exchange (8;20), or is part thereof.
11. Mobile locating system according to any of the preceding claims,  
25 characterised in that the responder device (3) comprises a mathematical processor (47) which in operation provides output signals to a transmitter section (47;55;65).
12. Mobile locating system according to any of the preceding claims,  
30 characterised in that the search device (1) is arranged to directly or indirectly receive positional signals relating to the position of the search device (1) and the position of the responder device (3), and is additionally provided with means to determine, based on said positional signals, in which direction and at which distance from the  
35 search device (1) the responder device (3) is.
13. Mobile locating system according to any of the claims 1 to 10 inclusive, characterised in that the exchange (8;20) is arranged to

transmit positional signals relating to the responder device (3) and the search device (1) on the direction and distance of the responder device (3) with respect to the search device (1) to the search device (1), and that the search device (1) is arranged to receive said  
5 information and display it using display means (35;72).

14. Mobile locating system according to any of the preceding claims, characterised in that the search device (1) comprises a compass device (43).  
10

15. Mobile locating system according to any of the preceding claims, characterised in that the search device (1) is provided with a display screen (35;72) and with electronic control circuits (39,41) which are capable of controlling the display screen (35;72) in such a manner  
15 that it displays positional information relating to at least the responder device (3).

16. Mobile locating system according to claim 15, characterised in that the positional information comprises graphical and/or  
20 alphanumeric information.

17. Mobile locating system according to claim 15 or 16, characterised in that the positional information comprises a plan.

25 18. Mobile locating system according to any of the preceding claims, characterised in that the communication between search device (1) and exchange (8;20), or between responder device (3) and exchange (8;20), respectively, takes place by way of several networks.

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FIG. 1

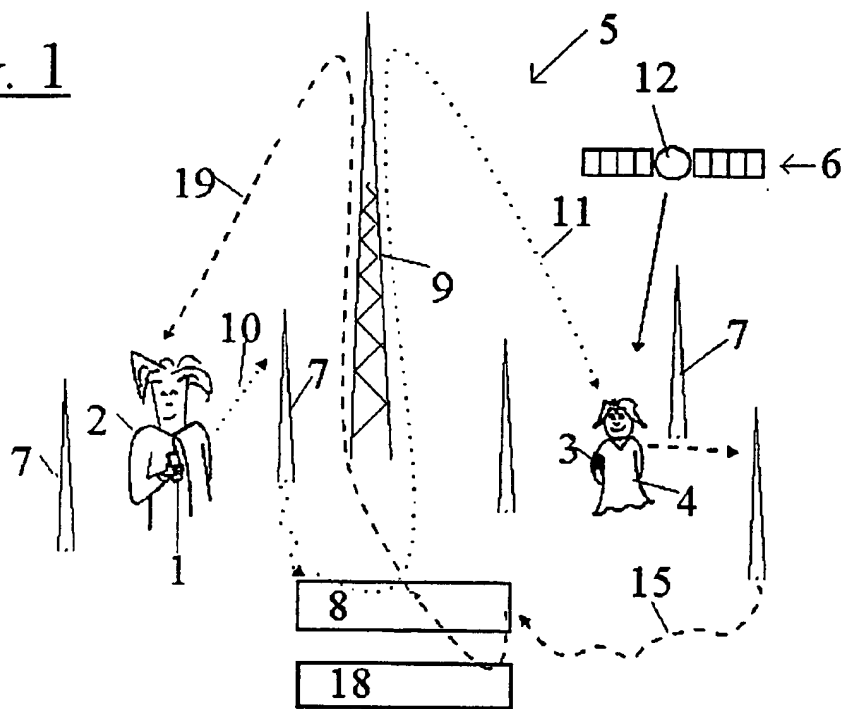
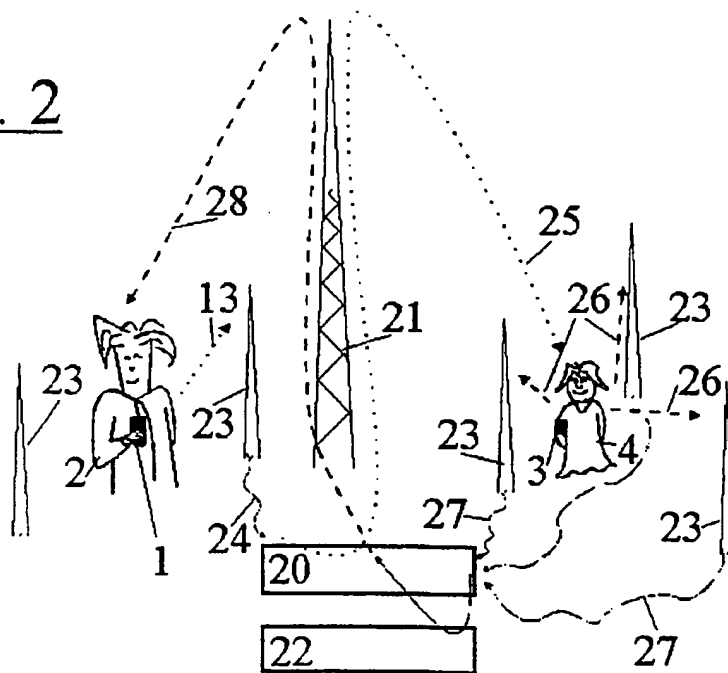
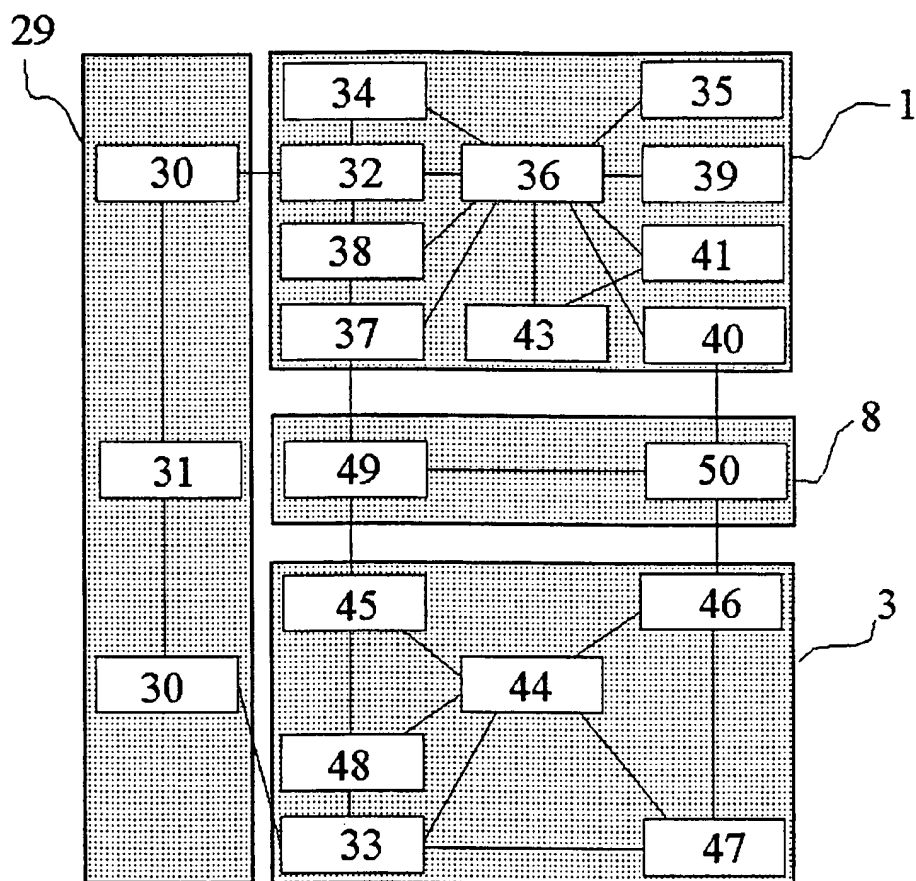


FIG. 2

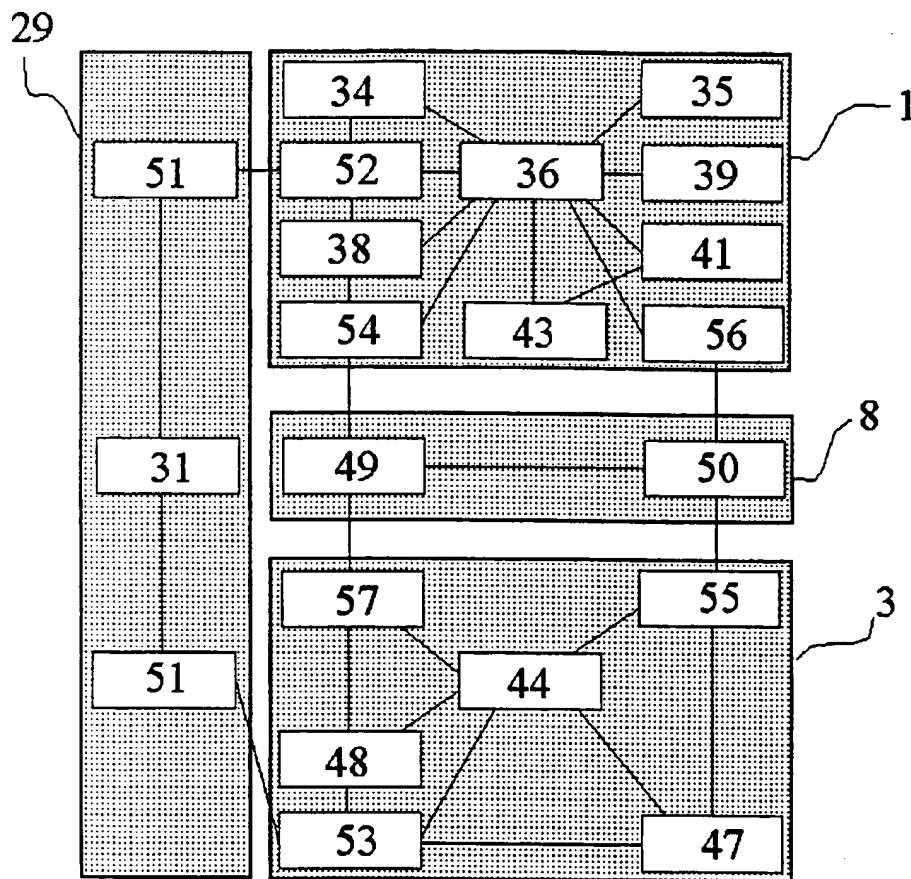


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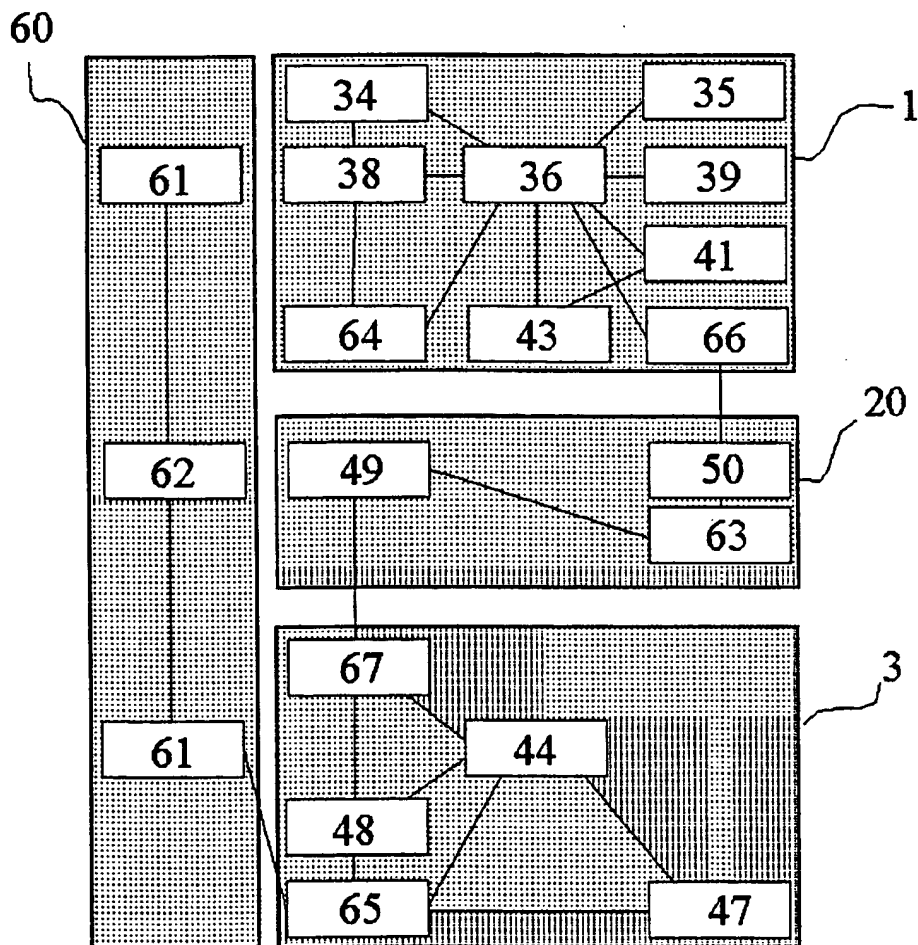
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FIG. 3



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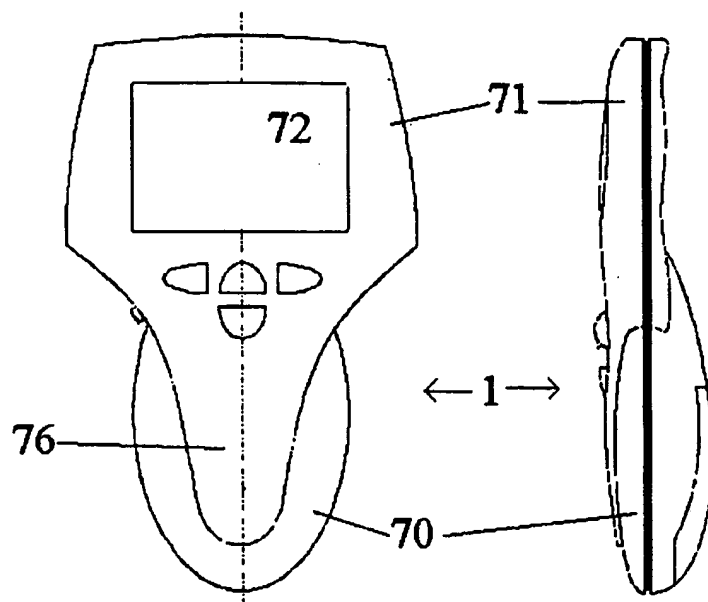
FIG. 4



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FIG. 5



**FIG. 6**

# INTERNATIONAL SEARCH REPORT

national Application No  
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<b>A. CLASSIFICATION OF SUBJECT MATTER</b> IPC 6 G01S5/14 G01S13/87		
According to International Patent Classification (IPC) or to both national classification and IPC		
<b>B. FIELDS SEARCHED</b> Minimum documentation searched (classification system followed by classification symbols) IPC 6 G01S		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practical, search terms used)		
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 97 14054 A (SNAPTRACK INC) 17 April 1997 (1997-04-17)	1,2,8, 11,15-18
Y	page 2, paragraph 5 - page 3, paragraph 5  page 8, paragraph 2 - page 9, paragraph 3 page 10, paragraph 2 page 12, paragraph 3 ---	3-7,9, 10,12-14
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A	abstract page 1, line 1 - line 11 page 5, line 26 - page 6, line 14; figures 5,8  --- -/--	11,15,16
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Date of the actual completion of the international search  26 July 1999		Date of mailing of the international search report  03/08/1999
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016		Authorized officer  Roost, J

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
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